



Genetics

University Research & Genetic Engineering In The Midwest

By Sarah Bantz

This January, Dr. Randall Prather, an animal science researcher at the University of Missouri, announced a breakthrough in his effort to create genetically engineered miniature pigs with organs suitable for transplant into humans. The shortage of human organs available for transplant has motivated some to look to other species, although the human body readily rejects the foreign organs. By manipulating the porcine genome to eliminate the gene suspected to be responsible for producing an enzyme that triggers the rejection in the human body, Prather hopes to create pig organs that will not be rejected. So far, he has eliminated one copy of the gene, bringing cross-species organ transplants, called xenotransplantation, one step closer to reality.

Press coverage celebrates his efforts to end the loss of human life. Prather is described as a farm boy and veterinarian's son whose scientific curiosity and desire to help farmers propelled him to agricultural research. The description of Prather and his research offered by the press meshes neatly with the public interest research mission of the University of Missouri's Land Grant College of Agriculture, where Prather's experiments are explained as a process of well meaning scientists using sophisticated biotechnology to benefit humankind.

Yet Prather's research, and biotechnology in general, is widely

criticized for weakening rural farm economies, creating products harmful to the environment and human body, and increasing the corporate share of public food and health care spending. What does Prather and his home institution, Missouri's publicly funded Land Grant College of Agriculture, expect to accomplish through this research?

Among those lauding Prather's contribution in the news is a representative from Immerge Biotherapeutics, whose relationship to Prather's research remains unexplained. Immerge is new firm, a joint venture between Biotransplant, a Boston-based biotechnology company, and Novartis, a multinational life sciences giant. Immerge Biotherapeutics's mission is to build a business selling organs for transplant. For the company, Prather's pigs are an attractive idea because, if successful, they will combine the low costs of agricultural production with high revenues of pharmaceuticals and medical technologies.

Biotransplant began funding Prather's research in the early 1990s. Since that time, the company has given at least \$750,000 for the pig research. In return for their financial support, the company receives first crack at commercializing and marketing any invention that comes from the research. Rather than placing research in the public realm, as has been the long tradition at Land

Grant Universities, MU has patented Prather's efforts and licensed them exclusively to Biotransplant. According to their agreement, Prather's ability to publish, present his research, or work on research that may overlap with this project is restricted by the company. Like much of the university research today, Prather's efforts are not public interest research, but are aimed to enhance and protect value for the funding company.

Private funds are only part of Prather's story. Prather has also received more than \$1.1 million in public money from the National Institutes of Health, as well as funds from the Department of Agriculture and through the university.

In addition, the National Institutes of Health gave Immerge \$1.7 million under the Advanced Technology Program, a program that "bridges the gap between the research lab and the market place." Using an economic development rationale, federal research agencies since the 1980s have offered research grants to private firms for product development.

In addition, through the National Institutes of Health Small Business Innovation Research program, another nearly \$1.3 million in public dollars was given to Biotransplant between 1996 and 2001. The SBIR funders overlooked the fact that Sandoz, a multinational pharmaceutical firm now subsumed into Novartis, has held some equity in Biotransplant since the early 1990s.

Today, Novartis holds 67 percent ownership in Immerge Biotherapeutics. Altogether, federal agencies have invested five times more money in Prather's research than the private sector has. The scandal of Prather's pigs is more than the private purchase of public university research, it is the transformation of public efforts into

private benefits for an agribusiness and pharmaceutical giant.

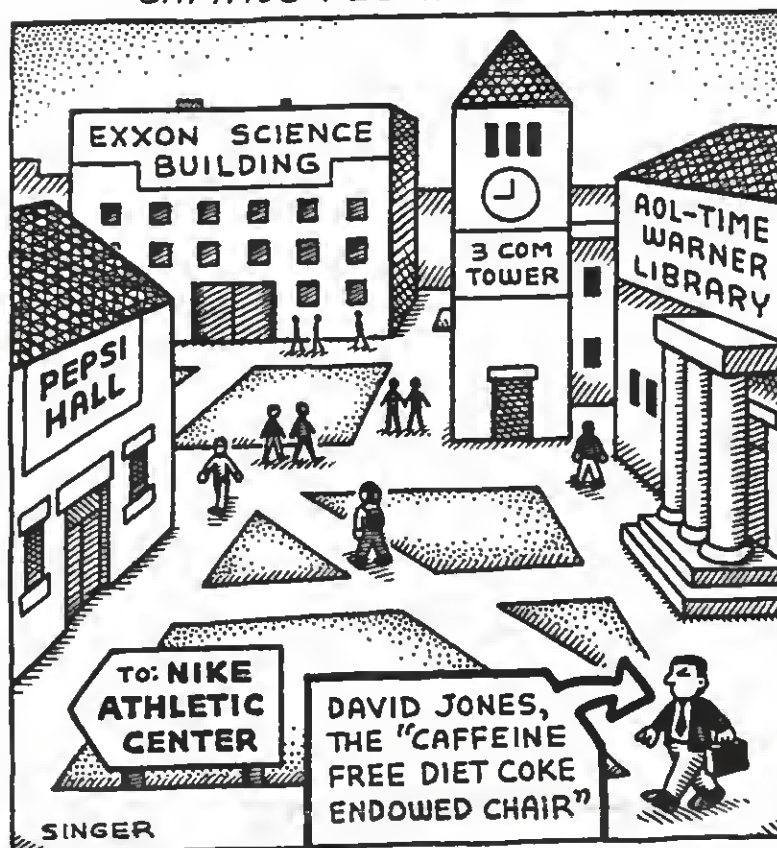
MU, like other Land Grant Universities, was founded under the Hatch Act of 1887, which directed these universities to "have for their purpose the development and improvement of the rural home and rural life and the maximum contribution by agriculture to the welfare of the consumer..." and to provide these services to the public regardless of social status. In the early 1980s, new federal law and a string of court decisions resulted in the legal inclusion of university research and living organisms as private property. This opened the opportunity for the university to gain royalty revenues by patenting and selling university inventions to private firms. Nowhere has this been more the case than in biotechnology. According to the U.S. patents office, in the class of patents called "multicellular organisms," universities hold 14 times more patents than all other patent holders, including industry. Universities make nearly 80 percent of their royalties from life science related inventions.

In addition, Land Grants have seen their traditional base of financial support erode—funds allocated by the federal government that for a century have let each university devise a research agenda based on local and regional needs. This decentralized decision making has been replaced by competitive grants organized around a federal agenda that prioritizes biotechnology and commercially applicable research.

These changes leave farmers, whose needs and concerns are often at odds with the big companies, without support. Land Grants have traditionally developed new public strains and varieties of plants and animals, available to farmers at no cost. Today, Land Grant efforts are encapsulated in patented, private varieties that

The Modern University

"CAPIMUS PECUNIAM TUAM"



benefit the most wealthy of the agricultural community, the agribusiness companies that can afford to pay license fees. Prather's pigs are but one example of this trend.

In order to attract industry dollars, federal competitive funds, and possible lucrative royalties, MU needed to invest in capital improvements and build its research capacity. Collaboration between the University and State of Missouri has resulted in a dizzying array of tax incentives, joint research initiatives, and new construction projects to support Missouri's fledgling agricultural biotechnology industry.

Efforts began in 1997 when U.S. Senator Christopher Bond, Missouri's biotechnology cheerleader, secured \$1.2 million per year in pork barrel handouts from the Department of Agriculture, available almost exclusively to researchers at the University of Illi-

nois and the University of Missouri. Originally a brainstorm of Monsanto CEO Robert Shapiro, criteria for applicants include interest in research outcome by a private firm. In 1999, the National Science Foundation granted \$7.5 million for a greenhouse as part of a project to map the corn genome. The university claims this map will benefit plant breeders, yet only those breeders able to afford the high technology investments to use genetic information will benefit, certainly not farmers. More recently and also through Bond's efforts, MU received \$29 million from NASA, matched with nearly \$30 million from the State of Missouri to build a Life Sciences Center that will house 50 new faculty positions. Groundbreaking for the new building took place last fall during a state budget crunch, a university-wide hiring freeze, and rumored dismantling of some fac-

ulty positions to make way for the new life sciences.

Not only the university, but the state of Missouri too has jumped onto the biotechnology bandwagon. The Danforth Plant Science Center, dedicated to plant biotechnology research and "rapid development and commercialization of promising technologies and products" received a \$50 million plus land donation from the Monsanto Foundation and \$25 million in state income tax credits from the state of Missouri. Located across from Monsanto's headquarters in Creve Coeur, discoveries made at the Danforth Center will be patented and licensed to the private sector, while individual research projects will draw funding primarily from public sources.

Benefits to life science companies also include \$21.5 million per year in research funds from Missouri's tobacco settlement payment, a state sales tax exemption, and \$1 million in property tax credits. In another new twist in university-industry relations, MU and Washington University have invested in a life science seed capital fund to which the state has approved \$20 million in tax credits for investors. Seed capital, considered more risky than venture capital, is made available to small firms sometimes before the firm is formed. Future plans include a 90,000 square foot technology park and small business incubator at the university, also to be funded by the state.

These funds are the most prominent aspect of increasingly sophisticated university involvement in aid to industry. In 1999, Monsanto considered sending its subsidiary, Integrated Protein Technologies, out of state. IPT "grows" enzymes and proteins in field crops for use in pharmaceuticals. To keep the company, the Missouri Department of Economic Development offered space at a new research

park on conservation land, a deal to trade up to \$3 million for research at a public Missouri University "paid" for by Monsanto's income tax credits. University scientists and administrators met with IPT officials to discuss potential research topics, which included many hard science topics as well as "public acceptance," "media" and "marketing" of biotechnology. While the research park deal fell through because of local citizen concern, MU has undertaken a number of research projects for IPT, and reviewing its end of the year accomplishments, claimed its successful partnership with IPT as an exemplary use of university resources.

The actions of Missouri's Land Grant University and state economic development agents might be less of a concern if some consensus existed that agricultural biotechnology was a public benefit. Yet while the University of Missouri joins industry to avidly promote genetically engineered foods and fiber, only the smallest resources are used to address hazards and risks of the new technologies.

While the race is on to create the transgenic pig capable of producing donor organs, what research is taking place to determine if it is safe? The transfer of pig organs to humans may introduce porcine viruses into human hosts, leading some virologists to reject the concept of xenotransplantation on the grounds of possible epidemic viral outbreaks. In order to turn the size of profit these companies expect, the purchase of organs makes xenotransplantation necessarily more expensive than human-to-human transplants. With transplants already too costly for most, the drive to make money from their exclusively patented organ transfer makes xenotransplantation an option only for the wealthiest. While lack of basic health care and sanitation remain

the biggest threats to public health, is xenotransplantation truly a public priority?

For genetically engineered field crops, questions concerning soil health, beneficial insects, pollen drift, and new superweeds have hardly been addressed. With widespread contamination already negating the possibility of 100 percent non-engineered corn, who is doing the research to certify that IPT's pharmaceutical corn will not escape via pollen or seed into the food supply? Scant attention has been paid to how ownership of the technology promotes consolidation among agricultural companies and weakens family farms and rural economies. No one has launched a serious investigation into the long-term affects of eating genetically engineered foods on human health. The amount of money that the USDA allocates to biotechnology risk assessment, at \$1.5 million for 2002, would cover expenses for only one of the thousands of product-development biotechnology research projects taking place today. At MU, only one research project over ten years has looked to uncover risk. MU's financial interests have led it to join industry and the federal government in minimizing those concerns and chastising those who raise them. Public interest research questions may be more pertinent than ever, yet no one has stepped up to take on the public interest role that Land Grants have vacated.

MU and the state of Missouri use the rubric of economic development, claiming that the public is served through service to industry. The peculiar twist of logic allows Jack Burns, former vice provost for research at MU, to invoke the public service mission to help industry. In an editorial entitled "University becoming economic engines for states" he says, "It is our obligation to help migrate new discoveries from the laboratory to

the marketplace." Senator Bond refers to the stretch of interstate 70 from Kansas City to St. Louis that encompass Missouri's universities and biotechnology related industries, as the new "Silicon Valley of biotechnology," as if the state's midwestern economy might pupate into something resembling southern California.

Not only is Missouri racing to secure Silicon Valley status, but so is nearly every other Midwestern state. Indiana has invested nearly \$50 million into biotechnology research and development and plans to spend some portion of their tobacco settlement funds on agricultural and medical biotechnology research. To create Michigan's Life Sciences Corridor, both Dow and Pharmacia (formerly Monsanto) have partnered with Michigan State University and the University of Michigan, while the state legislature allocated all \$50 million annually for 20 years of the state's revenues from tobacco settlement funds to universities, research institutions, and the industry. In Iowa, the long-term partnership between Iowa State University and Pioneer Hi-Bred has been infused with new energy and monies, most notably \$10 million annually for plant biotechnology research from the state legislature. In the same budget the state cut \$250,000 from the Leopold Center for Sustainable Agriculture, housed at Iowa State University.

The sum of these efforts through time and across many states and universities adds up to a tremendous public investment in a class of technologies of dubious public merit. As is the case with Prather's pigs, federal financial support for a genetic engineering product can outstrip a company's own investment. From this angle, genetically engineered foods, fibers, and medicines look to be more a creation of the public sector aide to private industry than

the result of supply and demand. Rather than benefiting people, these unproven technologies manage to squeeze further corporate profit from the consumer food dollar and health care budget. The genetic engineering issue reaches far beyond our supermarket shelves and coffee shop creamer, deep into our universities, state governments, and federal agencies from which these products emerge. **Z**



Mexico

Genetically Modified Organisms Threaten Indigenous Corn

By S'ra DeSantis

In November 2001, Ignacio Chapela and David Quist, scientists from the University of California at Berkeley, published an article in the scientific journal *Nature* revealing that indigenous corn in Oaxaca, Mexico was contaminated with DNA from genetically modified organisms (GMOs). The biotech industry has been working ferociously to discredit this research. Many of the anti-Chapela/Quist editorials and articles have been directly traced back to Monsanto's public relations firm. Pressure and criticism from a small group of influential biotech supporters caused *Nature* to withdraw the article in April 2002. Since this event, the biotech industry has reported that the genetic contamination in Mexico

never occurred. Unfortunately, most of the mainstream media coverage in the recent months has focused on the controversy over Chapela and Quist's research and has disregarded the ramifications this contamination will have. The introduction of DNA from genetically altered material could cause the native corn to lose its ability to produce and reproduce in its natural environment, destabilizing the economic livelihood of campesinos (small-scale farmers).

Most of the pro-biotech editorials and articles conveniently ignore the fact that two Mexican governmental agencies, the National Commission on Biodiversity (Conabio) and the National Ecological Institute (INE), sampled indigenous corn from 20 communities in Oaxaca and 2 in Puebla (states in southern Mexico). They found that 95 percent of these communities had a 1 to 35 percent contamination rate. This means that between 1 percent and 35 percent of the indigenous kernels they sampled contained traces of DNA from genetically modified organisms (GMOs). In total, 8 percent of the 1,876 of the seedlings they tested were polluted by GMOs. At the Biosafety Conference in The Hague at the end of April 2002, Jorge Soberon, director of Conabio, declared this genetic pollution as the worst case of GMO contamination in crops ever reported in the world.

Corn: The Life-force

The campesino lifestyle depends on corn, which provides their nutrition, economic livelihood, and the basis for many religious ceremonies. In order to ensure the continued existence of the corn, campesinos must disperse the seed. Without human intervention, the cob would fall on the ground and all the kernels would compete with each other. After a few generations the corn would no longer